Claims

1. A polynucleotide sequence encoding a Human Papillomavirus (HPV) polypeptide having epitopes from at least two Early antigens or fragments thereof from two different HPV strains.

2. A polynucleotide as claimed in claim 1 wherein at least one antigen is derived from HPV E1 or fragment thereof.

3. A polynucleotide as claimed in claim 2 wherein at least one antigen is derived from HPV E2.

4. A polynucleotide sequence according to any of claims 1 to 3 which is a DNA sequence.

5. A polynucleotide sequence according to any of claims 1 to 4 which encodes a HPV polypeptide of a HPV type or sub-type associated with cervical cancer, benign cutaneous warts or genital warts.

6. A polynucleotide sequence according to any of claims 1 to 5 which encodes a HPV polypeptide of one of types 1-4, 6, 7, 10, 11, 16, 18, 26-29, 31, 33, 35, 39, 49, 51, 52, 56, 58, 59 and 68.

7. A polynucleotide sequence according 6 which encodes a HPV polypeptide of an HPV type or sub-type which is associated with cervical cancer or genital warts.

8. A polynucleotide sequence according to claim 4 or 5 which encodes a HPV polypeptide of one of types 6, 11, 16, 18, 33 or 45.

9. A polynucleotide sequence according to claim 5 which encodes a HPV polypeptide of a HPV type or sub-type selected from HPV 11, 6a or 6b.

10. A polynucleotide sequence according to any preceding claim in which encodes a mutated HPV polypeptide having reduced biological function.

11. A polynucleotide sequence according to any of claims 1 to 10 which encodes a mutated HPV polypeptide comprising one or more point mutations by which one or more of the polypeptide's natural biological functions is inactivated.

12. A polynucleotide sequence according to any preceding claim having a codon usage coefficient for human genes of greater than 0.4 but less than 1.

13. A polynucleotide sequence according to claim 12 having a codon usage coefficient for human genes of greater than 0.5 but less than 1.

14. An expression vector comprising a polynucleotide sequence according to any preceding claim operably linked to a control sequence which is capable of providing for the expression of the polynulceotide sequence by a host cell.

15. An expression vector according to claim 14 which is p7313PLc.

16. A pharmaceutical composition comprising a polynucleotide sequence according to any one of claims 1-13.

17. A pharmaceutical composition comprising a vector according to any one of claims 14-15.

18. A pharmaceutical composition according to claim 16 or claim 17 comprising a plurality, gold particles, coated with DNA.

19. A pharmaceutical composition according to any one of claims 16, 17 or 18 further comprising an adjuvant.

20. A pharmaceutical composition according to claim 19 in which the adjuvant is encoded as a fusion with the HPV polypeptide encoded by the polynucleotide.

21. The use of a polynucleotide according to any one of claims 1-13 in the treatment or prophylaxis of an HPV infection.

22. The use of a vector according to any one of claims 14-15 in the treatment or prophylaxis of a HPV infection.

23. The use of a composition according to any one of claims 18-20 in the treatment or prophylaxis of an HPV infection.

24. The use of a polynucleotide according to any one of claims 1-13, a vector according to any one of claims 14-15 or a pharmaceutical composition according to any one of claims 16-20 in the treatment or prophylaxis of cutaneous (skin) warts, genital warts, atypical squamous cells of undetermined significance (ASCUS), cervical dysplasia, cervical intraepithelial neoplasia (CIN) or cervical cancer.

25. A method of treating or preventing HPV infections or any symptoms or diseases associated therewith, comprising administering an effective amount of a polynucleotide according to any one of claims 1-13, a vector according to any one of claims 14 or 15 or a pharmaceutical composition according to any one of claims 16-20.

26. A method of treating or preventing HPV infections or any symptoms or diseases associated therewith, comprising administering a pharmaceutical composition according to 16-20 in a prime-boost dosage regime with a recombinant viral vector or non-viral based system comprising a polynucleotide according to any one of claims 1-13.